REMARKS

Claims 1-30 are presented for further examination. Claims 1, 2, 5, 12, 17, 20, 24-27, and 30 have been amended.

In the Office Action mailed May 21, 2003, claim 24 was rejected under 35 U.S.C. § 112 for lack of antecedent basis. Claim 24 has been amended to overcome this rejection.

Claims 1-3, 17-18, 20, 24, and 30 were rejected under 35 U.S.C. § 102(a) as anticipated by U.S. Patent No. 6,305,221 ("Hutchings"). Claims 4, 5, 8-10, 19, 21, 25, and 26 were rejected under 35 U.S.C. § 103(a) as obvious over Hutchings in view of U.S. Patent No. 6,251,048 ("Kaufman"). Claims 6-7, 11-16, and 27-29 were rejected as obvious over Hutchings in view of Kaufman and further in view of U.S. Patent No. 5,921,890 ("Miley"). Claims 22-23 were rejected under 35 U.S.C. § 103(a) as unpatentable over Hutchings in view of Miley.

Applicants respectfully disagree with the bases for the rejections and request reconsideration and further examination of the claims.

The present invention is directed to a device for determining information about the repetitive movement of a human body, and in particular a preferred embodiment sensing the <u>static acceleration</u> of a swimmer to generate information about movement identification, movement patterns, elapsed times, start and stop times, breathing patterns, and the like (see Abstract of the Disclosure).

In the remarks that follow, the term "static acceleration" is used synonymously with "gravitational acceleration," and "dynamic acceleration" is used synonymously with "linear acceleration."

The disclosed embodiments of the invention are directed to an exercise motion detector where repetitive movement information is extracted from the static acceleration component of an acceleration signal delivered by an accelerometer. Ideally, the sensing of static acceleration is performed by a two-axis accelerometer. The device and method of the present invention do not utilize the more expensive and unnecessary magnetometers and rotational sensors or the sensing and processing of dynamic acceleration.

Hutchings, U.S. Patent No. 6,305,221, is directed to a rotational sensor system that utilizes accelerometers and rotational sensors to determine accurate <u>distance</u> and

instantaneous speed, two parameters that are not determined in the present invention. Hutchings further teaches the use of magnetometers to measure rotation. These additional sensors are required for the determination of instantaneous speed and accurate distance.

In order to measure speed and distance, Hutchings teaches a reference frame coordinate system and a translation coordinate system that moves with his device. The translation coordinate system involves one set of three-component linear accelerometers and one set of three-component rotational sensors. Accelerations recorded in the translation system comprise both static and dynamic acceleration. Hutchings teaches using only the dynamic acceleration for double integration over time in order to provide information about the length of travel (see Hutchings, column 4, lines 32-34). Therefore, as stated by Hutchings, the component of static acceleration must be avoided (see Hutchings, column 4, lines 43-49).

Hutchings teaches the use of accelerometers and rotational sensors to measure acceleration each time the foot wearing the device of Hutchings touches the ground. At that time, the velocity of the user is constant and the dynamic acceleration falls to zero, leading to a measure of only the static or gravitational acceleration. The value of the static acceleration is then subtracted from the global value of the acceleration signal sent by the accelerometers when the foot leaves the ground and moves in space until it touches the ground again. This leads to a measure of the dynamic acceleration, which is the use of a signal processed by Hutchings in order to determine the measure of instantaneous speed and length of travel. The present invention utilizes the static or gravitational acceleration as the signal for processing in order to detect, track, display, and identify repetitive movement.

Moreover, Hutchings teaches the use of neural networks to improve accuracy in his signal processing method (see column 6, lines 11-12). In addition, Hutchings discusses how the motion of a swimmer's hand can be analyzed in three dimensions. He states that such a measurement involves multiple coordinate systems, such as a reference frame coordinate system and a translation coordinate system, moving with the device, both requiring additional hardware such as rotational sensors, magnetometers, or global positioning system (GPS). In contrast, the present invention utilizes a two-axis accelerometer from which the component of static acceleration is processed; no neural network is used for processing the signal.

Hutchings teaches that accelerometers must be combined with magnetometers to measure accurate distance, instantaneous speed, and height (see column 20, lines 49-55, and column 23, lines 6-14). Most importantly, Hutchings describes exactly the type of signals generated by accelerometers in the sport of swimming, and he teaches that such signals must be generated by multiple sets of devices, each one comprising combinations of accelerometers and magnetometers, in an attempt to reduce random errors generated by situations where the apparent acceleration of the device is primarily due to the effect of tilt in the gravity field or the rate of tilt in the gravity field at a lower frequency than the changes in linear accelerations of the device. Nowhere does Hutchings teach or suggest the particular case of processing signals generated by static acceleration in order to extract information such as stroke count, lap count, and the like. Rather, Hutchings teaches the use of filtering (elimination) of the static acceleration in order to extract the dynamic acceleration, from which signal processing methods are applied to obtain information about distance, speed, and height (see column 24, lines 45-51).

Thus, employing the device of Hutchings in the context of swimming and applying the only processing method described in Hutchings would result in filtering (eliminating) the large component of static acceleration signals in an attempt to detect a much weaker dynamic acceleration signal generated by the swimmer's stroke. Detection of such a signal would also fall outside the sensitivity range of most of the accelerometers currently available on the market, requiring the use of more specialized and expensive accelerometers. Thus, in conclusion, Hutchings' method fails to provide a viable solution for counting strokes and laps in the sport of swimming.

Kaufman is directed to a system that provides verbal and motivational feedback to a user in response to his or her actions captured by a "conventional" exercise motion detector. This detector is purportedly designed for non-cardiovascular training equipment (column 2, lines 10-13, 24-31; and column 3, line 62 through column 4, line 30), and must receive a count of repetitive movement mostly during static exercises, such as sit-ups and pushups, by way of a mechanical switch used as an exercise motion detector (see column 6, lines 49-65; column 7, lines 33-44; column 9, lines 16-62; column 13, lines 31-34; column 16, lines 20-23, 27-30; column 25, lines 25-33; and column 26, lines 50-56).

Kaufman attempts to embrace a larger definition of motion detectors by characterizing them as motion detectors of conventional structure (see column 6, lines 24-33), and by making reference to "appropriate detecting means well known to those of ordinary skill in the art" (see column 10, lines 33-38; and column 25, lines 43-47). Based on the description of different embodiments in Kaufman, it is obvious that all motion detectors described by Kaufman provide a direct measure of the parameters intended to be monitored, and none of them, perhaps with the exception of a generic switch, is claimed. In other words, Kaufman does not disclose an exercise motion detector as described and claimed in the present application.

The present invention discloses a completely different system in which an exercise motion detector is designed specifically for swimming, which is a basic cardiovascular and dynamic (non-static) exercise. Key parameters such as stroke count, lap count, stroke detection, and breathing patterns are extracted after processing the static component of an acceleration signal delivered by an accelerometer. The disclosed and claimed embodiments of the invention do not and cannot use any switch to trigger a signal corresponding to a direct measure of one of these parameters for two reasons:

First, the signal delivered by the accelerometer does not provide a direct measure of any of these parameters; and

Second, when swimming, there is no static reference from which a switch could make contact in order to trigger a signal corresponding to the direct measure of one of the target parameters.

Sending the static acceleration signal as a direct output of the sensor of the present invention to the device described by Kaufman will make it impossible for the device to distinguish a stroke count from a lap count, or a breathing pattern, or more simply an artifact due to an interruption of the swim. Contrary to Kaufman's statement at column 27, lines 11-17, it is obvious that accelerometers do not enter in the category of detectors of conventional structure considered by Kaufman since they do not report a direct measure of the target parameters of the present invention and require extensive signal processing, two conditions that are not met by Kaufman's device.

While Kaufman does discuss very briefly the capability of monitoring a breathing pattern (see column 27, lines 28-38), Kaufman fails to describe a motion detector used under such circumstances. While one may speculate that a switch is pushed by the expansion or contraction of the chest against a static reference in order to induce a signal, the disclosed and claimed embodiments of the invention monitor breathing pattern after processing the variations of static acceleration reported by an accelerometer located preferably on a part of the body that moves when the subject is breathing. Kaufman teaches direct measurement of a signal, which is definitely not the case when an accelerometer is used as a motion detection sensor.

Miley, U.S. Patent No. 5,921,890, discloses a pacing device for helping a user to achieve a desired pace or tempo. In other words, Miley teaches defining a fixed stroke rate in advance. This is a feature that is not present in the disclosed and claimed embodiments of the present invention.

Miley describes at column 2, lines 50-60, the entry of two parameters:

First, a time interval corresponding to the intended user's pace. For example, setting a time interval of two seconds means the swimmer should complete a full stroke every two seconds.

Second, a split time, which is the time in which a course, such as a full length of a pool, should be completed. If the length of the pool is known, Miley explains that the user will be able to determine the number of strokes carried out per length. This statement assumes that the swimmer follows the pace set by the device before the swim, and it is no longer true when the swimmer no longer follows that particular pace! This is, of course, a completely different device that does not teach or suggest the detection and communication in real time of the number of strokes performed by a swimmer, regardless of the swimmer's pace. Thus, Miley fails to teach or suggest a device that can report the type of stroke sum by the athlete (crawl, breast stroke, etc.), as well as an accurate stroke count and lap count when the swimmer is not swimming in synchronization with the pacing signal.

Turning to the claims, claim 1 is directed to a device for determining information about the repetitive movement of the human body that comprises a sensor assembly having at least one static acceleration sensor configured to be mounted to the human body and to generate

at least one static acceleration signal; and a processor coupled to the sensor assembly and configured to determine at least one from among a movement identification, a movement count, a movement pattern, and a breathing pattern, in response to only the at least one static acceleration signal. As discussed above, Hutchings explicitly teaches the filtering out of the static acceleration component and utilizing only the dynamic acceleration component of its acceleration signals. Claim 17 recites the processing of first and second static acceleration signals as do claims 20, 24, and 30. Applicant respectfully submits that claims 1-3, 17-18, 20, 24, and 30 are not anticipated by Hutchings.

Dependent claims 4-5, 8-10, 19, 21, 25, and 26 are not suggested by the combinations of Hutchings with Kaufman because not only does Hutchings fail to teach or suggest the use of the static acceleration component of an acceleration signal, but the combination of Kaufman with Hutchings would fail to provide or suggest this feature. In addition, the combination of Kaufman with Hutchings falls short of the present invention because Kaufman teaches reliance on the direct measure of a signal in order to monitor breathing pattern, and this is at odds with the teachings of Hutchings. Even if one were motivated to combine the references as the Examiner suggests, such combination would fail to achieve the claimed combination of the present invention because it would not use the static acceleration component, thus requiring the use of more cumbersome, complicated, and expensive sensing and processing equipment.

All of the remaining claims depend from the independent claims discussed above, and thus would be allowable for the reasons discussed above with respect to these independent claims. Consequently, applicants respectfully submit that all of the claims in this application are now in condition for allowance. In the event the Examiner finds minor informalities that can be resolved by telephone conference, the Examiner is urged to contact applicants' undersigned representative by telephone at (206) 622-4900 in order to expeditiously resolve prosecution of this application. Consequently, early and favorable action allowing these claims and passing this case to issuance is respectfully solicited.

The Commissioner is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

Pascal Roncalez et al.

SEED Intellectual Property Law Group PLLC

E. Russell Tarleton

E. Russell Tarleton
Registration No. 31,800

ERT:aep

Enclosure:
Postcard

701 Fifth Avenue, Suite 6300
Seattle, Washington 98104-7092
Phone: (206) 622-4900
Fax: (206) 682-6031

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